Comments on
"Delta Independent Science Board (DISB) Water Quality Review Draft Proposal"

G. Fred Lee, PhD, BCEES, F. ASCE & Anne Jones Lee, PhD
G. Fred Lee & Associates
El Macero, CA
gfredlee33@gmail.com www.gfredlee.com

August 7, 2015

In response to the DISB's request for comments on its *Water Quality Review Draft Proposal* we wish to submit the following comments.

Overall, we find that the draft proposal seems adequate for the rather broad-brush scope of the topics covered. However, it fails to adequately address the need for monitoring in the Central and Southern Delta channels to evaluate current water quality conditions and, most important, how the water quality in those areas of the Delta will be altered by implementation of the so-called "Tunnel Diversion" of large amounts Sacramento River water around the Delta.

Background to These Comments

We first became involved in Delta water quality issues in the spring of 1989 as I was winding down my 30-years of graduate university teaching and research (during which time I conducted about $5 million in research and developed about 500 professional papers and reports) and shifting my professional focus to fulltime consulting. In the spring of 1989, while holding positions of Distinguished Professor of Environmental Engineering (Lee) and Associate Professor (Jones-Lee) at the New Jersey Institute of Technology we became consultants to the Delta Wetlands on water quality issues in proposed Delta water supply reservoirs. During that summer we also became consultants to Metropolitan Water District of Southern California on the pollution of groundwaters by municipal solid waste landfills, and became involved in assessing impacts of Lake Tahoe shoreline development on the lake's water quality. In the fall of 1989 we moved from New Jersey to El Macero, CA (near Davis, CA) and established our fulltime consulting business, G. Fred Lee & Associates, in which we continue to be active. Associated with our consulting projects and professional service activities we continue to develop professional papers and reports; many of our more than 1100 professional papers and reports are posted on our website, www.gfredlee.com. About 50 of our papers and reports are devoted to Delta water quality issues. A summary of our Delta water quality investigations/reports is available as,

> Lee, G. F., and Jones-Lee, A., "Experience in Reviewing Delta Water Quality Issues," G. Fred Lee & Associates, El Macero, CA, April 3 (2011).
> http://www.gfredlee.com/SJR-Delta/GFLAJL-Delta-EXP-REV.pdf

In 2000 we became active as advisors to Bill Jennings (DeltaKeeper) on Delta water quality issues. At that time I started attending the SJR DO TMDL Technical Advisory Committee meetings to assist the DeltaKeeper in reviewing water quality issues of the San Joaquin River (SJR) Deep Water Ship Channel (DWSC), particularly the low-DO problem. Since I had had considerable experience in similar issues in other areas of the US I became a leader in the SJR

DO TMDL steering committee's review of the SJR DWSC low-DO problem. This led to my serving as the principal investigator for the CalFed $2-million study of that problem. As the project PI and on behalf of the steering committee and CalFed, I coordinated the investigations of 12 investigators' projects and conducted independent research on this project. In 2003 we developed a synthesis report covering the research projects for all the projects:

> Lee. G. F., and Jones-Lee, A., "Synthesis and Discussion of Findings on the Causes and Factors Influencing Low DO in the San Joaquin River Deep Water Ship Channel near Stockton, CA: Including 2002 Data," Report Submitted to SJR DO TMDL Steering Committee/Technical Advisory Committee and CALFED Bay-Delta Program, G. Fred Lee & Associates, El Macero, CA, March (2003).
> http://www.gfredlee.com/SJR-Delta/SynthesisRpt3-21-03.pdf
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> Lee, G. F. and Jones-Lee, A., "Supplement to Synthesis Report on the Low-DO Problem in the SJR DWSC," Report of G. Fred Lee & Associates, El Macero, CA, June (2004).
> http://www.gfredlee.com/SJR-Delta/SynthRptSupp.pdf

Since 2003 we have continued to be active in investigating water quality issues in the SJR DWSC and the Delta in general; our professional reports, papers, and comments on these issues are available in the San Joaquin River Delta section of our website [http://www.gfredlee.com/psjriv2.html].

On April 27, 2015 we submitted comments on the DISB draft report on fishes and flows in the Delta, which discussed the importance of flow into and through Delta channels in affecting Delta water quality:

> Lee, G. F., and Jones-Lee, A., "Comments on Delta Independent Science Board (Delta ISB)'s Draft Report, 'Fishes and Flows in the Sacramento-San Joaquin Delta: Strategic Science Needs'," Submitted via email to Kelly Souza, Senior Environmental Scientist Delta Science Program, Delta Stewardship Council, Sacramento, CA, Report of G. Fred Lee & Associates, El Macero, CA, April 27 (2015).
> http://www.gfredlee.com/SJR-Delta/Fishes_Flows_ISB_Comments.pdf

Many of our reports cited in those comments evolved from our work on SJR DWSC low-DO studies. Of particular importance were the follow-on studies that we did with DeltaKeeper support on southern and Central Delta, including those reported in:

> Lee, G. F., Jones-Lee, A. and Burr, K., "Summary of Results from the July 17, 2003, and September 17, 2003, Tours of the Central Delta Channels," Report of G. Fred Lee & Associates, El Macero, CA (2004).
> http://www.gfredlee.com/SJR-Delta/Central-Delta-Tours.pdf
>
> Lee, G. F., Jones-Lee, A. and Burr, K., "Results of the August 5, 2003,Tour of the South Delta Channels," Report of G. Fred Lee & Associates, El Macero, CA, February (2004).
> http://www.gfredlee.com/SJR-Delta/South-Delta-Tour.pdf

Those studies also led to our development of several additional reports on these issues, including:

> Lee, G. F., and Jones-Lee, A., "SJR Deep Water Ship Channel Water Not SJR Watershed

Water below Columbia Cut," Report of G. Fred Lee & Associates, El Macero, CA (2003). Submitted for publication in the IEP Newsletter, October (2003). http://www.gfredlee.com/SJR-Delta/IEP-SJR-Delta7-24-03Final.pdf

Lee, G. F., and Jones-Lee, A., "Impact of State and Federal Delta Water Export Projects on Delta Water Quality and Aquatic Resources: Issues That Need to Be Addressed," Report of G. Fred Lee & Associates, El Macero, CA, October (2004). http://www.gfredlee.com/SJR-Delta/ImpactDelExpProj.pdf

Lee, G. F., and Jones-Lee, A., "Impact of SJR & South Delta Flow Diversions on Water Quality," PowerPoint Slides, Presentation to CA Water Resources Control Board, D1641 Water Rights Review, January 24 (2005). http://www.gfredlee.com/SJR-Delta/D1641SlidesSWRCBJan2005.pdf

Gross, E.S., Lee, G. F., Simenstad, C. A., Stacey, M., Williams, J.G., (Expert Panel Members), "Panel Review of the CA Department of Fish and Game's Quantifiable Biological Objectives and Flow Criteria for Aquatic and Terrestrial Species of Concern Dependent on the Delta," DFG Water Rights Program Documents Senate Bill X7 1 DFG Implementation, Submitted to California Department of Fish and Game, October (2010). Also available at http://www.dfg.ca.gov/water/water_rights_docs.html http://www.gfredlee.com/SJR-Delta/Final_Panel_Review_DFG_BOFC_Draft.pdf

Lee, G., F., and Jones-Lee, A., "Need for Reliable Water Quality Monitoring/Evaluation of the Impact of SWRCB Water Rights Decisions on Water Quality in the Delta and Its Tributaries," Submitted to CA Water Resources Control Board Workshop on D-1641 Water Rights, Sacramento, CA, March 22 (2005). http://www.gfredlee.com/SJR-Delta/DeltaWaterExportImpactsPaper.pdf

Lee, G. F., and Jones-Lee, A., "Review of Need for Modeling of the Impact of Altered Flow through and around the Sacramento San Joaquin Delta on Delta Water Quality Issues," and "Summary: Water Quality Modeling Associated with Altered Sacramento River Flows in & around the Delta," Report to CWEMF Stormwater Committee, by G. Fred Lee & Associates, El Macero, CA, March (2009). http://www.gfredlee.com/SJR-Delta/Model-Impact-Flow-Delta.pdf

Lee, G. F., and Jones-Lee, A, "Review of Impacts of Delta Water Quality and Delta Water Exports on the Decline of Chinook Salmon in the SJR Watershed," Comments submitted to NMFS Southwest Fisheries Science Center, NOAA, Santa Cruz, CA, by G. Fred Lee & Associates, El Macero, CA, August (2008). http://www.gfredlee.com/SJR-Delta/Salmon-NOAAcom.pdf

Lee, G. F., and Jones-Lee, A., "Enhanced Delta Flows Needed to Help Control Water Quality Impacts of Delta Pollutants," Testimony for CA State Water Resources Control Board Public Workshop: Comprehensive (Phase 2) Review & Update to Bay-Delta Plan Workshop 1: Ecosystem Changes and the Low Salinity Zone, Sacramento, CA, September 5, 2012, Report of G. Fred Lee & Associates, El Macero, CA, August 17

(2012). http://www.gfredlee.com/SJR-Delta/Lee_Testimony_BayDelta_Workshop_1.pdf

Lee, G. F., and Jones-Lee, A., "Enhanced Delta Flows Needed to Help Control Water Quality Impacts of Delta Pollutants," PowerPoint Slides for Testimony for CA State Water Resources Control Board Public Workshop: Comprehensive (Phase 2) Review & Update to Bay-Delta Plan Workshop 1: Ecosystem Changes and the Low Salinity Zone, Sacramento, CA, G. Fred Lee & Associates, El Macero, CA, September 5 (2012). http://www. gfredlee.com/SJR-Delta/Enhanced_Delta_Flow_Testimony_Ppt.pdf

Lee, G. F., and Jones-Lee, A., "Comments on Water Quality Issues Associated with SWRCB's Developing Flow Criteria for Protection of the Public Trust Aquatic Life Resources of the Delta," Submitted to CA State Water Resources Control Board as part of Public Trust Delta Flow Criteria Development, by G. Fred Lee & Associates, El Macero, CA, February 11 (2010). http://www.gfredlee.com/SJR-Delta/Public_Trust_WQ.pdf

On July 2014 we submitted comments on technical deficiencies in the BDCP draft EIS/EIR review of Delta water quality as influenced by altered flow of Sacramento River flow through the Delta:

Lee, G. F., and Jones-Lee, A., "Comments on Bay Delta Conservation Plan (BDCP) Draft EIR/EIS Chapter 8 – Water Quality, Chapter 25 – Public Health, July 25, 2014," Comments submitted as part of comments provided by California Sportfishing Protection Alliance, Stockton, CA to Ryan Wulff, NOAA National Marine Fisheries Service, Sacramento, CA, July 28 (2014). http://www.gfredlee.com/SJR-Delta/Comments_BDCP_draftEIR_EIS_July2014.pdf

In those comments we discuss the deficiency in the draft EIR/EIS in its failure to consider the impact of altered Sacramento River flow into the Delta resulting from "Tunnel Diversions" on water quality in the Central Delta channel. We are reviewing the revised EIS/EIR and find that the revised discussion of Delta water quality is still highly deficient in evaluating the water quality impacts of the "Tunnel Diversions" of Sacramento River water around the Delta. The updated EIS/EIR failed to discuss the implications of the fact that that diversion would deprive the Central Delta of several thousand cfs of Sacramento River water that currently dilutes the SJR flow entering the Central Delta at Turner and Columbia Cuts. The Central Delta a key part of the Delta ecosystem for fish and other aquatic life. As we found in DeltaKeeper-supported cruises, the current flow pattern is such that the South Delta export pumps pull Sacramento River water into the Central Delta via these "Cuts" thereby diluting the pollutants from the SJR water. Our reports on these issues, some of which are cited above, are available on our website in the SJR-Delta section at http://www.gfredlee.com/psjriv2.html.

In March 2008, Dr. Lee organized the "Delta Nutrient Water Quality Modeling Workshop" on behalf of the California Water and Environmental Modeling Forum (CWEMF) designed to provide an overview of the current nutrient-related water quality issues and problems (based on impairment of beneficial uses) in the Sacramento San Joaquin Delta, by more than a dozen professionals in these topics. The workshop also focused on the current ability to model the relationships between nutrient (nitrogen and phosphorus) loads/concentrations and nutrient-

related water quality problems. A summary of the workshop presentations is provided in:

Lee, G. F., and Jones-Lee, A., "Synopsis of CWEMF Delta Nutrient Water Quality Modeling Workshop – March 25, 2008, Sacramento, CA," Report of G. Fred Lee & Associates, El Macero, CA, May 15 (2008). http://www.gfredlee.com/SJR-Delta/CWEMF_WS_synopsis.pdf

At the CWEMF workshop, Dr. Erwin van Nieuwenhuyse, Fishery Biologist with the US Bureau of Reclamation Division of Environmental Affairs, Sacramento, CA discussed, "Impact of Sacramento River Input of Phosphorus to the Delta on Algal Growth in the Delta." His presentation summarized his recent paper describing the response of average summer chlorophyll concentration in the Central Delta to an abrupt and sustained reduction in phosphorus discharge from the Sacramento County Regional Sanitation District wastewater treatment facility. That paper is available as:

vanNieuwenhuyse, E., "Response of Summer Chlorophyll Concentration to Reduced Total Phosphorus Concentration in the Rhine River (Netherlands) and the Sacramento–San Joaquin Delta (California, USA)," Can. J. Fish. Aquatic, Sci. 64(11):1529-1542 (2007).
[http://www.ingentaconnect.com/content/nrc/cjfas/2007/00000064/00000011/art00006]

His CWEMF Delta Nutrient Workshop presentation provides important information on the impact of Sacramento River flow into the Central Delta and the Sacramento County Regional Sanitation District phosphorus discharge on planktonic algae in the Central Delta. The slides from Dr. van Nieuwenhuyse's workshop presentation are available at, http://www.cwemf.org/workshops/DeltaNutrientsWrkshp/VanNieuwenhuyse.pdf.

Finding that altering the phosphorus load to the Delta impacts its planktonic algal chlorophyll is in accord with the findings of Lee and his co-workers on waterbodies worldwide; many of their publications and reports on these issues are available in the "Nutrients & Eutrophication" section of his website, www.gfredlee.com, including:

Rast, W., Jones, A., and Lee, G. F., "Predictive Capability of US OECD Phosphorus Loading-Eutrophication Response Models," Journ. Water Pollut. Control Fed. 55(7):990-1003 (1983). http://www.gfredlee.com/Nutrients/PredictiveCapabilityOECD.pdf

Lee, G. F., "G. Fred Lee's Expertise and Experience in Investigating & Managing Excessive Fertilization in Waterbodies and Developing Nutrient Criteria," Submitted to SWRCB Nutrient Objectives Stakeholder Advisory Group (SAG), Sacramento, CA by G. Fred Lee & Associates, El Macero, CA, June (2014).
http://www.gfredlee.com/exp/GFL_Nutrient_Expertise.pdf

Rast, W., and Lee, G. F., "Summary Analysis of the North American (US Portion) OECD Eutrophication Project: Nutrient Loading--Lake Response Relationships and Trophic State Indices," EPA 600/3-78-008, US EPA Corvallis, OR (1978).
http://www.gfredlee.com/Nutrients/Rast_Lee_OECD_Report.pdf

Lee, G. F., and Jones-Lee, A., "Delta Nutrient Water Quality Modeling Workshop — Background Information," Report of G. Fred Lee & Associates, El Macero, CA,

September (2007). http://www.gfredlee.com/Nutrients/NutrWorkshopRev4.pdf

Lee, G. F. and Jones-Lee, A., "Assessing the Water Quality Impacts of Phosphorus in Runoff from Agricultural Lands," IN: Hall, W. L. and Robarge, W. P. (eds.), Environmental Impact of Fertilizer on Soil and Water, American Chemical Society Symposium Series 872, Oxford University Press, Cary, NC, pp. 207-219 (2004). http://www.gfredlee.com/Nutrients/P_Runoff_Ag_ACS.pdf

Lee, G. F. and Jones-Lee, A., "Assessing the Water Quality Impacts of Phosphorus in Runoff from Agricultural Lands: Expanded Discussion," Presented in part at American Chemical Society Agro Division Symposium, "Environmental Impact of Fertilizer Products in Soil, Air and Water," Chicago, IL, August (2001). (Published in part in Symposium Proceedings (Lee and Jones-Lee, 2004) [http://www.gfredlee.com/Nutrients/P_Runoff_Ag_ACS.pdf]) (http://www.gfredlee.com/ ag_p-1_012002.pdf) http://www.gfredlee.com/Nutrients/ag_p-1_012002.pdf

Jones, R. A. and Lee, G. F., "Use of Vollenweider-OECD Modeling to Evaluate Aquatic Ecosystem Functioning," Functional Testing of Aquatic Biota for Estimating Hazards of Chemicals, ASTM STP 988, Amer. Soc. Test. & Mat., Philadelphia, pp. 17-27 (1988). http://www.gfredlee.com/Nutrients/EcosystemFunctionOECD.pdf

Conclusion

The DISB draft water quality review should be significantly expanded to include water quality monitoring in the Central and Southern Delta to provide detailed information to define how Delta water quality can be impacted by alterations in Sacramento River flow into and through the Delta. As discussed in our above-referenced reports, such monitoring should be directed to gaining a reliable understanding of the impacts of alterations in the flow patterns of the Sacramento River through and around the Delta on water quality in the Delta and in the diversion waters.

If there are questions on these issues please contact us.

G. Fred Lee and Anne Jones-Lee